STEM PROJECT

Harvesting the Wind

What is the best design for a wind turbine that can harvest the maximum amount of energy?

There is a new kind of farm that is unlike any other—it doesn't produce food—it produces energy from wind. These farms can reduce our dependence on fossil fuels by generating electricity from the powerful forces in wind.

A wind turbine is almost the opposite of a fan. A fan uses electricity to make wind; a turbine uses wind to make electricity. Wind turns the turbine's blades, which spins a shaft that connects to a generator, which produces electricity. In this way, wind energy can be "harvested" so that you can turn on a light or use a toaster.

The biggest problem with wind power is obvious: Wind comes and goes. It cannot be counted on to blow when electricity is needed. It does not blow at a steady rate. Also, the best sites for wind farms are often in remote locations, in mountains or deserts, far from cities where the most electricity is needed. Better methods of harvesting in areas with less wind speed are needed.

Imagine that you are a wind industry engineer who designs, analyzes, and tests wind turbines to improve performance. You start by building working models. What is the best design for an efficient wind turbine?

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IDENTIFY A NEED

The goal of this project is to design, build and test a working model of a wind turbine that can generate the most electricity with a medium wind speed. The first step is to develop a problem statement for your project. Use the questions below to help you write your statement.

- What is a problem or need in this scenario?
- Who has the problem or need?
- Why is it important to address the need?

RESEARCH

Do some Internet research to find some answers to these questions:

a. How are wind turbines designed to maximize the amount of wind power harvested from a site?

b. What are the components of a wind turbine and what is the function of each component?

c. What important questions remain to be answered by engineers and analysts who study wind energy?

The Engineering Cycle

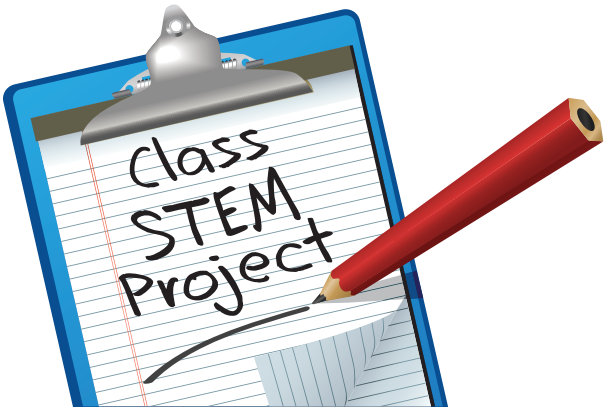
SPECIFY REQUIREMENTS

Working in groups of 3-5 classmates, design, build and test a model wind turbine using the materials your teacher provides.

a. What are the criteria for your wind turbine?

b. What are the constraints for your wind turbine?

SELECT DESIGN



Your model wind turbine will be built from the materials your teacher provides your team. The materials provided will include a base, a turbine with slots to attach blades and also slots to place magnets, different numbers and shapes of blades, and magnets from which you will be able to vary number and location in the turbine.

1. Based on your research, select blade shape and number of blades you want to use in your design.

2. Select the number and orientation of magnets that you will use in your design. Write down the function of the magnets in a wind turbine.

3. Sketch your design, label its parts, and list their functions.

BUILD PROTOTYPE

Build your wind turbine model and do a preliminary test to make sure it works.

TEST AND EVALUATE

Design a test to determine how much power your model wind turbine generates at a medium fan speed. Conduct your test and collect data. Make revisions to your design and retest until your group is satisfied that your wind turbine design generates the maximum power.

COMMUNICATE

Present your design and data to the class for feedback and suggestions.

need ⇢ design ⇢ prototype ⇢ test ⇢ evaluate
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